

Auto Repair FOR **DUMMIES®** 2ND EDITION

by Deanna Sclar
John O'Dell, Technical Advisor



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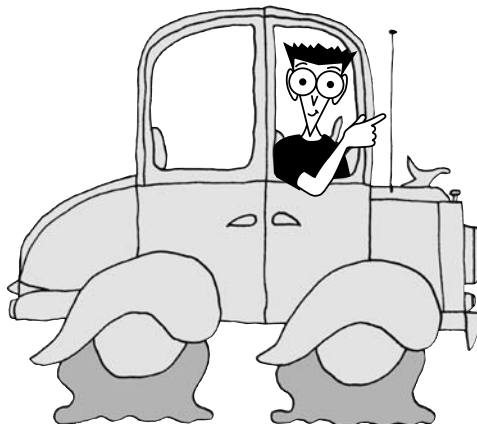
About the Author

Deanna Sclar is also the internationally best-selling author of *Buying a Car For Dummies*, a money-saving guide to every aspect of car ownership including buying, selling, financing, auto insurance and claims, and more. A former contributing editor to *Family Circle*, *Boys' Life*, *Exploring*, and the *Los Angeles Times*, her articles have appeared in *Redbook*, *New Woman*, and other national magazines.

As an automotive expert and consumer spokesperson, Deanna has appeared on more than 800 radio and TV shows, including her own segment on *NBC Nightly News with Tom Brokaw*; *Good Morning America*, *Today*; the Lifetime, CNN, and National Public Radio networks; and local shows in 30 major cities. Her *Auto Repair For Dummies* video was a National Home Video Awards finalist. She's co-hosted *Outrageous Women*, a weekly TV talk show, and has produced, written, hosted, and edited several documentaries. Her "Auto Repair for Dummies" course at California State University, Northridge, drew the largest crowds ever in their continuing education program.

A life-long environmental activist, Deanna led the group that threw the first Earth Day celebration in New York City and convinced Mayor Lindsay to start the first urban recycling program. The former "Thumbs Sclar" has restored two classic cars, a truck, and three homes. An inveterate gypsy and blue-water sailor, she has crewed her way across the Pacific and Polynesia, sailed and dived Hawaii and the Great Barrier Reef, trekked alone for nine months through southeast Asia and five months through Brazil, and crossed the Atlantic in a small sailboat with a companion and a cat.

"My goal is to prove that we have control over our lives," she says. "Whether you are working on a car or making a lifelong dream come true, it's a do-it-yourself world. Knowing this has turned my life into a great adventure, and I want to pass the good news on to everybody else!"



Dedication

For my children, Gina and Casey; and my grandchildren, Jesse, Allison, Jacob, and Kylie, who will drive the vehicles of the future.

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What's So Special about Auto Repair For Dummies, 2nd Edition

This book is designed for people who think that anything technical will make their brains shut like garage doors, who sincerely care about how their vehicles affect the environment, and although they believe they can't work on their cars themselves — and wouldn't like it if they could — are willing to give it a try. How do I know that it will work for these reluctant readers? Because it's written by a genuine, certified ex-Dummy who has found that, despite total ignorance and a complete lack of manual dexterity, getting personally involved with a vehicle is enjoyable, rewarding, and easy. Believe me: If I can do it, so can you!

It Is *Not* Written for Confirmed “Do-It-Yourselfers.” It *Is* for You If:

- ✔ You have never held a wrench.
- ✔ You are positive that, in your case, manual labor can lead only to disaster.
- ✔ You haven't the vaguest idea of how a car works.
- ✔ You have failed shop or arts and crafts.
- ✔ You believe that if you do something wrong, your car can blow up.

To Enjoy This Book, It Would Help If:

- ✔ You don't believe that working on your vehicle can possibly be fun, but you're willing to give it a try for any reason whatsoever.
- ✔ You are sincerely tired of being ripped off because of your own ignorance.

Why Is That Enjoyable? Because You Will Be Delighted to Find:

- ✔ Cars run on principles that are as easy to understand as common sense.
- ✔ You can save a tremendous amount of money, extend the life of your vehicle, save on fuel, and do your bit for the environment if you know more about your car!
- ✔ Most of the devices on your vehicle will not hurt you unless you really go out of your way to hurt yourself.

Here's How *Auto Repair For Dummies* Accomplishes These Miracles:

- ✔ It starts from scratch. It even shows you what a screwdriver looks like!
- ✔ It explains each system in simple terms *before* you get to work on it.
- ✔ It provides step-by-step instructions for even the simplest tasks.
- ✔ It tells you exactly what you need and how to know if you've been given the wrong part, the wrong diagnosis, or an outrageous estimate.

It Tells You the Truth About:

- ✓ What makes your vehicle go (and how and why as well)
- ✓ How the car you drive, how you drive it and maintain it, and how you recycle or dispose of used parts and toxic fluids affect fuel economy and global warming
- ✓ The easy work involved in keeping your vehicle well maintained and running efficiently, and how to tell what's wrong if trouble strikes
- ✓ How 15 minutes of "preventive medicine" avoids breakdowns
- ✓ Whether you can handle a problem yourself, and how to get it fixed at a fair price if you can't
- ✓ How to extend the life of your vehicle; keep it clean and healthy; and repair the minor dents and dings it acquires on the road

These Features Will Make Life Even Easier:

- ✓ A *Practical Glossary of Automotive Terms* that are in *special type* throughout the book so that you can refresh your memory if you've forgotten what something means
- ✓ A detailed *Index* where you can look up a part, a problem, a symptom, or a specific job and find the page you need
- ✓ A *Maintenance Record* so you can keep track of what you've done and when you did it
- ✓ A *Specifications Record* for the data you need to buy the right parts
- ✓ Tons of illustrations that show you how things look and where they are

This Revised Edition Also Tells You:

- ✓ About alternatively fueled vehicles and other innovations so you can choose a safe and efficient vehicle when Old Faithful finally heads for the Used Car Lot in the Sky

You Have a Few Things to Supply, Too!

- ✓ You have to buy the book . . . and read it!
- ✓ You have to try to do one small, easy job yourself (you can pick the job).

There Are Fringe Benefits, Too!

- ✓ Your vehicle will run better and live longer.
- ✓ Automotive technicians will respect you.
- ✓ You'll have more money to spend on other things.
- ✓ You'll no longer be a Dummy!

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Introduction

For many people, getting a driver's license is an event that runs second only to getting a diploma or a marriage license. Most of us succeed in passing the test and hop happily into our vehicles, headed for the freedom of the open road. Unfortunately, most of us don't know the first thing about the machines we're licensed to drive — and this can turn a ticket to freedom into a ticket to trouble.

I'm not necessarily talking about physical danger. State motor vehicle bureaus have made fairly sure that, before we can get a driver's license, we know how to drive defensively and can handle a vehicle under poor driving conditions. What I'm referring to is the kind of trouble that comes from depending on other people to care for and repair our vehicles. If you're like most people, you probably tend to drive around until something goes wrong and then incur the expense of replacing worn and burned-out parts — or the entire vehicle! — when low-cost, regular maintenance could have kept your wheels turning for a long time.

Whether you're trying to cut expenses, are tired of being patronized, or have just fallen in love with your first car, this book tells you how your vehicle works, what it needs in the way of tender loving care, how to reduce its impact on the environment, and how to keep from getting ripped off if you have to entrust repairs to someone else. By handling the simple maintenance and being able to diagnose trouble and perform the less complex repairs yourself, you'll earn the respect of your family, your mechanic, and your car — and you'll feel pretty good about it!

About This Book

This new edition is about much more than auto repair. In this book, I introduce you to the wonders of the internal combustion engine and to the even more wondrous alternative fuels and alternatively fueled vehicles that reduce dependence on the rapidly dwindling supply of fossil fuel and will play a huge role in the battle against global warming that threatens the future of the planet. I'm proud to say that this edition of *Auto Repair For Dummies* is the first “green” automotive guide that focuses on how the vehicles you choose; the way you maintain them; and how you recycle used oil, parts you've replaced, and other waste products directly affects the environment.

The book starts off with the basics every driver should know, from how to get the hood open and fill up with fuel, to using a jack and changing a tire safely.

You learn the basic safety rules to follow when dealing with your vehicle, and how to take *anything* apart and reassemble it without losing anything, including your mind! After identifying the basic tools you may need, I gently lead you into an easy preventive maintenance check-up that you can do to extend the life of your vehicle and keep it from breaking down on the road.

Next, there's a quick overview of how your vehicle's principal systems work together to start it, operate it efficiently on the road, and bring it safely to a stop. After you have a general idea of how things work, we explore each system, part by part, and what needs to be done to maintain it, troubleshoot it, and do minor repairs yourself. Don't worry about getting in over your head. If a repair can get you into trouble if you attempt to do it yourself, I tell you how to be sure the work is done properly by a professional at a fair price. So don't chicken out on me! Start with the easy stuff and then take on the more challenging tasks.

How I Became Intimately Involved with My Car, and Why You Should Too

Before I moved to California, I was an ordinary urban cliff dweller: I had only a nodding acquaintance with cars. Ours was locked up in a garage, and I used subways, buses, and taxis. All the maintenance on our car was done by the garage that housed it. When we moved to California, my enthusiasm for a life in the sun was considerably dampened by the knowledge that this would also include a life on the freeways, but the first time I took the family car to the supermarket myself I had an epiphany in the parking lot: I could drive anywhere I wanted to, instead of just being driven home. It wasn't long before I was looking for a car of my own.

The best I could do was a secondhand Mustang with more than 70,000 miles on it. A friend of mine checked out the car and pronounced it drivable. He said that it might need "a little work." We took it to a reliable mechanic, who checked it over, tuned it up, and told me that it was "a classic."

Thus reassured, I drove the car to the Department of Motor Vehicles to register it. I parked the car, turned off the ignition, locked it, and found that the car was singing! A bit puzzled, I rechecked the ignition and the radio, but everything was truly shut off. And still the car sang. By the time I returned, all was quiet. But that night, when I took the family out to dinner, old Tweety Bird began to sing again. After several weeks of expensive and unsuccessful repairs, I found out that all she had needed was an inexpensive radiator cap. To my amazement, the shop was unwilling to refund the money I'd spent on all the other stuff they'd tried! I realized that it would be impossible to communicate with Tweety properly if I didn't know anything about her, and the repair bills were going to send both of us down the drain.

So I conned a friend of mine into taking an auto shop class with me at a local adult-ed center. Instead of a bewildering array of weird objects and miles of hoses that threatened to blow up if I turned a screw in the wrong direction, I soon found that a car was just a series of simple mechanisms linked together and that vehicles are very good about sending out signals telling you clearly what's wrong — if you know how to hear, see, smell, or feel them.

Before long, it was no longer enough to be able to communicate with a mechanic; I wanted to be the mechanic *myself* whenever possible. Not only did I save money, but Tweety began running better, and I found that not only was I saving money and fuel, I was having *fun*!

Today, vehicles are more complex because computers control many systems and even professional mechanics need specialized equipment to deal with them. The upside is that these vehicles usually need fewer repairs, and there are much greater intervals between basic maintenance tasks, most of which are still easily done yourself. The same goes for making a variety of minor repairs and adjustments.

Unlike professional mechanics, when *you* do the troubleshooting (that's CarSpeak for diagnosing a problem by analyzing the symptoms), you can try the cheaper solutions first. For example, if your engine has been overheating constantly, you check the radiator cap and the coolant level, look for leaks in the hoses, and check the thermostat *before* paying for a new water pump. If it's the cap, a hose, or the thermostat, you may be able to easily replace it yourself, and the money you'll save is well worth the effort. If it finally comes down to changing the water pump, you can ask the mechanic about installing a good rebuilt pump instead of an expensive new one.

With this book as your guide to how cars work, you may discover that your vehicle stops being a mystery and begins to be fun to hang around with. When you realize that a vehicle exhibits most of the symptoms of life — it's self-propelled, reacts to outside stimuli, consumes fuel and discharges wastes, and even manages to sing a little tune now and then — it's really hard not to respond to it as though it were another living thing.

Conventions Used in This Book

The following conventions are used throughout the text to make things consistent and easy to understand:

- ✓ All Web addresses appear in `monofont`.
- ✓ Whenever you encounter a term set in **this font**, you'll find it defined in the glossary in Appendix A.
- ✓ *Italic* is used to note technical terms that aren't defined in the glossary.

- ✔ **Bold** is used to highlight the action parts of numbered steps as well as key information in lists.
- ✔ Sidebars are the shaded boxes that appear here and there. They contain information that's interesting and insightful and that may help you out in your auto repair adventures. However, you won't be at a serious disadvantage if you stick to the regular text and save the sidebars to read later on.

How I Picture You

In order to make this book as relevant, readable, and enjoyable as possible, I envision it as a friendly conversation with the kind of person I feel would want to read it. Here's my mental portrait of my readers:

- ✔ You're intelligent and may know a great deal about a lot of things (law, business, literature, medicine, and other nonautomotive subjects), but you need some help when it comes to cars.
- ✔ You're tired of living as a "closet dummy" who nods and smiles at the incomprehensible mutterings of your mechanic, only to end up shelling out money for repairs that you neither fully understand nor always need.
- ✔ You've decided that it simply isn't worth the extra money to have other people do things for you that you can do yourself.
- ✔ You're tired of other people assuming (especially if you're a teenager, a senior, or a woman) that you aren't capable of handling repairs yourself.
- ✔ You want to keep a good vehicle in good condition without paying dearly to have someone else do the simple maintenance, or you want to keep your old heap running just a little longer without spending a lot of money on it.
- ✔ You want to maintain your vehicle *without* devoting every weekend, weeknight, and spare lunch hour to poring over the intricacies, details, and mysteries of the internal combustion engine.
- ✔ You've realized (I hope!) that a vehicle that runs inefficiently because it's poorly maintained or is running on fossil fuel pollutes the environment, and you want to do something to turn that around.

How This Book Is Organized

Basically, this book covers everything you need to know to understand, care for, maintain, and troubleshoot your vehicle, or choose a new, more efficient, and safer one. You'll be relieved to know that I explain everything in everyday terms, with no jargon, no unnecessary technical details, and lots of simple illustrations.

To help you find information easily, this book is divided into seven parts, each containing chapters that deal with a particular topic. Because the key to doing *any* job is to understand what you're working on and how it functions, I strongly recommend that you read the chapter that deals with the system you want to work on *before* you head for the chapter that tells you how to do a specific job. The following sections describe the information that you can find in each part.

Part I: Getting to Know Your Vehicle

If you want the basics, this is the part for you. I cover things that everyone who drives should know, like how to decide whether you want to do a job yourself, how to get the hood open, how to use a jack and change a tire, and how to take *anything* apart and put it back together again. A monthly under-the-hood check that can prevent 70 percent of highway breakdowns will transform you from an “I-can’t-do-it-myself” into a hands-on mechanic. I also describe the tools that you’ll need to borrow or buy if you plan to do regular maintenance and simple repairs. Finally, a quick and simple run-through of how basic automotive systems work together gives you the confidence to explore further because what was once a mystery is now familiar territory.

Part II: Powering Up with Air, Fuel, and Fire

This part provides a closer look at the electrical and fuel systems in vehicles with internal combustion engines and tells you how to do simple jobs related to each one. If you own or would like to own an alternatively fueled vehicle, you’ll find information on how diesel, hybrid, multifuel, natural gas, and hydrogen vehicles work; descriptions of a variety of alternative fuels; and the advantages and disadvantages of each.

Part III: Staying Cool and In Control

This part deals with the cooling system, how oil benefits your vehicle, and how the brake system works. You find out how to prevent and deal with chronic overheating, add and change coolant, find and repair leaks, change your oil, check and maintain your brakes, pack wheel bearings, and do a variety of other vital tasks.

Part IV: Smoothing the Ride: Steering and Suspension, Tires and Transmissions

How comfortably and efficiently a vehicle operates is hugely influenced by the systems covered in this part of the book. This part tells you how all these systems operate and shows you how to choose the right tires, read the wealth of information on the sidewalls and the treads to prevent tires from wearing out prematurely, about balancing and alignment, and how to fill tires with the proper amount of air. The chapters on transmissions explain how they work, how to troubleshoot symptoms, and how to obtain the best deal on repairs, along with driving techniques that will extend the life of your transmission.

Part V: Staying Safe and Dealing with Emergencies

This part helps you deal with problems that may occur while you're away from home. It describes a variety of new safety systems that help children ride comfortably and securely, prevent accidents and injuries, increase traction and stability, avoid rollovers, and even call for help without your assistance when your car is disabled or stolen. It shows you how to decipher such symptoms as weird noises, smoke, smells, and leaks to determine what's wrong; I also share what to do to get off the road safely, jump a start, and cool things down if your car overheats in traffic.

If a job is just too hairy to deal with yourself, I tell you how to find a reliable service facility and establish a good relationship with it, describe a problem so a mechanic can diagnose it swiftly and accurately, decipher a mechanic's invoice, and get satisfaction on complaints if, despite your best efforts, you run into problems with *anything* you buy.

Part VI: Helping Your Vehicle Look Its Best

Because keeping a vehicle clean — inside and out — can extend its life and value, in this part I cover washing and waxing the body, tidying up under the hood, cleaning the interior, and removing stains from fabric, carpeting, windows, and other surfaces. If your vehicle has suffered minor damage, I show you how to repair small dings, dents, and rust spots; touch up paint; and patch or install weatherstripping instead of paying big bucks for body shops to do it. If major work needs to be done I tell you how to choose the right type of parts, and how to evaluate body shops and get the best deal and highest quality work from them.

Part VII: The Part of Tens

This part can save you money, time, and sanity. It lists the most important preventive maintenance you can do to keep your vehicle in good condition and offers “eco-logical” tips for saving fuel.

Appendixes

I include two handy appendixes at the back of this book:

- ✓ The *Dictionary of Acronyms* and the *Practical Glossary* not only tell you what automotive terms mean but give you advice about them as well. Throughout the book, glossary terms are set in a **special font** to remind you to go to the glossary when you see a word that you don’t recognize or a term that you don’t understand.
- ✓ The handy *Specifications Record* makes sure that you have the numbers of the parts you need when you go to the auto supply store, and the *Maintenance Record* reminds you to get busy if you’ve let things go too long. The *Maintenance Record* also provides a history of maintenance and repair that will be an asset when it’s time to sell your vehicle or trade it in. Each record can be photocopied (before you enter any information on it) so you have one for every vehicle you own.

Icons Used in This Book

To make this book easier to read and simpler to use, I include some icons that can help you find and fathom key ideas and information.



This icon points to suggestions or hints that can make a task easier, save you money, help you avoid hassles, and otherwise make your life easier.



This icon appears beside information that you should watch out for because it points out events or circumstances that are dangerous or can end up costing you a lot of money.



This icon was specially created for this book to alert you to the relationship between a piece of information and its impact on the environment. The information will help you save fuel, cut air pollution, recycle parts, and dispose of toxic substances safely.



This icon appears beside rules that you absolutely *must* follow if you want to achieve success in a particular situation. There aren't many of them, so pay attention when you do come across them!



This icon indicates information that you may have encountered elsewhere in the book and need to take into consideration and keep in mind.



This icon appears beside technical information that, although interesting (at least to me), you can skip without risking anything important.



This icon appears beside real-life stories that provide a relaxing respite from serious subjects and demonstrate what you should — or should not — do to avoid major trouble or to triumph in difficult situations.

Where to Go from Here

You can use this book any way you want to. You can read it from cover to cover or jump from section to section as the mood strikes you. To find a general topic, head to the Table of Contents. If you're looking for more specific information, go to the Index.

No matter how you use the book, I recommend that you tuck it into your trunk compartment to keep it handy when it's time for maintenance or if you need to figure out what's gone wrong on the road.

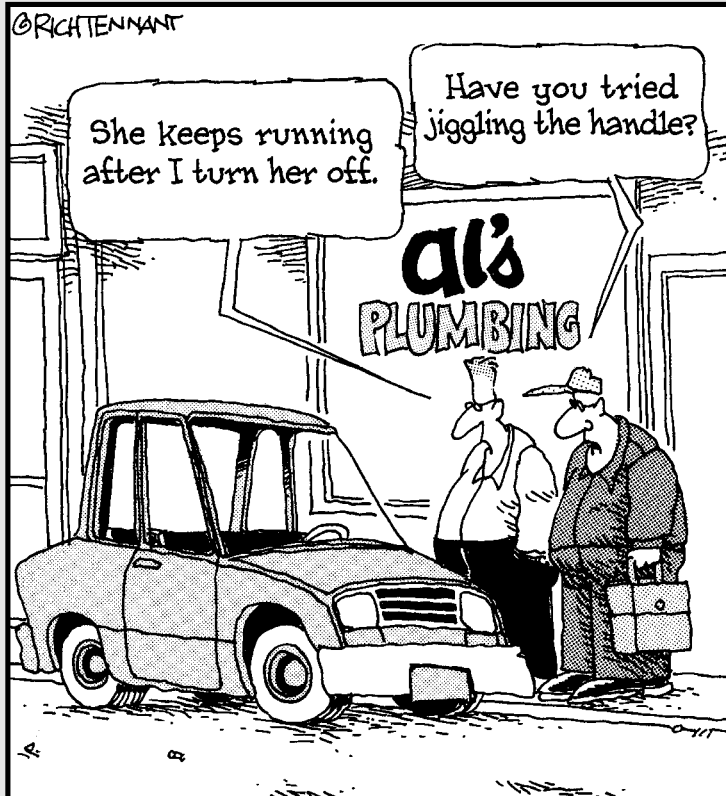
If this book turns you on to automotive systems and repair, then by all means extend your knowledge by reading more and more sophisticated literature on your favorite automotive topics. But there's no substitute for hands-on experience. You won't be able to realize any of your goals unless you stop procrastinating and start *working*. If you're feeling timid about actually *touching* your vehicle's inner parts, try doing something simple, like checking the oil dipstick or changing the air filter. I hope that you find it as exhilarating as I did, and I know that your car will love you for it. May you and your vehicle have a long and happy life together!

Part I

Getting to Know Your Vehicle

The 5th Wave

By Rich Tennant



In this part . . .

Ever seen someone try to figure out how to open a can of sardines? They have the key in one hand, the can in the other, and they poke, prod, and pry until they finally decide that saltines alone are fine. If you've ever tried to open the hood of your vehicle or jack it up without the benefit of prior experience (or paying attention when someone else did it), you may feel as confused as the sardine-lovers seem. That's why this part covers the things every driver should be able to do, safety tips that everyone who works on cars should know, and the tools you can use to get your vehicle running smoothly again. You find out how to buy the right auto part on your first trip to the store and how to do a monthly under-the-hood check that can prevent breakdowns on the road by *70 percent!*

Finally, I take a quick trip through all the automotive systems involved in operating your vehicle to show you what each one does, how it does it, and how they relate to one another.

Chapter 1

Things Every Driver Should Know

In This Chapter

- ▶ Knowing when to do it yourself
 - ▶ Paying attention to safety
 - ▶ Filling the tank yourself
 - ▶ Getting under the hood
 - ▶ Taking things apart (and putting them back together again)
 - ▶ Jacking up a vehicle and changing a tire safely
 - ▶ Getting into your car when you lock yourself out
-

If you're not particularly mechanically inclined, you may watch those who *are* with admiration, amazement, and exasperation because they have something you don't: an understanding of how things work and how things fit together. When they take something apart, they can reassemble it the way it was. When they say that they want to take a look under the hood, they can actually get the darn thing open. And when they need to change a flat, they don't spend ten minutes trying to figure out which end of the jack is up.

The good news is that you don't have to be born with a wrench in your hand to know how to fix things — even things as seemingly complicated as a car. I know; I've been there. The Introduction tells you all about my automotive epiphany.

Of course, the simplest tasks can sometimes be the biggest hurdles to overcome. After all, if you can't even figure out how to open the hood, how can you check the **oil** or the **coolant** level? That's why I begin this book with the basics: simple jobs that you'll need to do again and again — like opening the hood, jacking up a car, and changing a tire. I also include instructions for filling the fuel tank yourself (it's cheaper than full-service), a surefire method for taking *anything* apart and putting it back together again, and safety pointers that *every* mechanic — experienced and beginner — should heed.



Whenever you encounter a term set in **this font**, you'll find it defined in the glossary in Appendix A.

Before You Tackle Any Job

It's wonderful to do things yourself. You spend less money, you get a sense of power knowing that you did it on your own, and you know that the job's been done right. Nevertheless, to avoid getting in over my head, I always ask myself the following questions before undertaking *any* job:

- ✓ Do I really want to do this? Will it be fun — or horrendous? (I try never to do anything that doesn't *feel* good unless it's absolutely necessary.)
- ✓ Do I know how to do it? If not, where do I go to learn?
- ✓ Does it require such expensive tools that it would cost less to have someone do it for me than to buy those tools? Can I borrow or rent the tools I need?
- ✓ If I goof, can something be seriously damaged? Can I be hurt?
- ✓ How long will it take, and what is my time worth? From that perspective, how much money will I save by doing it myself?

You'll be happy to know that almost every job in this book should pass the test of these questions. If you find a task that doesn't, don't hesitate to turn it over to a professional — *after* you read enough to know that the job is definitely necessary, what it entails, whether the work has been done properly, and how to get satisfaction if it isn't. With that in mind, let's get on to the very first thing you need to know in order to work on your vehicle.

What the big guys taught me about busting things loose

If you try to remove a bolt or a spark plug and you can't budge it, don't feel like a weakling. At first I thought that I had trouble because I was female, so I asked the biggest guys in my auto class for help because it would have been embarrassing if some little guy could do it. To my amazement, I found that often the big guys struggled, too! The difference was that they always prevailed. What I learned from them is that strength depends less on size or sex and more on the way in which we've been taught to

focus our strength. People who are handy with tools usually have learned to pour their strength down their arms and into their hands, and focus it on the tool they're using. The guys also showed me that the longer the handle, the more leverage you have. And from watching them struggle, I learned that the patience to persevere comes from having the confidence that eventually you will succeed. So now I approach hard-to-move objects with the proper tools, focus, and patience. It works!

Buying the right parts for your vehicle

Before you go shopping for parts to replace those on your vehicle, read the tips in this section carefully. They can help you avoid what's probably the most annoying part of any automotive job: disabling your vehicle to work on it only to find that you need it to drive back to the store to exchange the stuff they sold you in error! Before I learned how to do it right, this happened at least two out of every three times on every job I did.



This section tells you what you need to know when buying *any* part. Sections in other chapters that deal with jobs that require buying replacement parts provide tips on buying them as well as what tools and other stuff you need for that task. Chapter 3 tells you how to buy specific tools and what they're used for.

To buy the proper parts for your vehicle, you must know its **specifications** (or "specs," as they're often called). Most of this information should be in your **owner's manual**, and a lot of it is also printed on metal tags or decals located inside your hood. You can usually find these in front of the radiator, inside the fenders, on the inside of the hood — anywhere the auto manufacturer thinks you'll find them. I know of one car that has its decal inside the lid of the glove compartment. These ID tags also provide a lot of other information about where the vehicle was made, what kind of paint it has, and so on.

The **service manual** for your vehicle should have the specs for the parts you need, and the parts department at your dealership or a reputable auto supply store can also look them up for you.



It's a good idea to stick with parts from the same manufacturer as those that your vehicle originally came with. That brand may be listed in a service manual for your vehicle. If you don't have a service manual, tell the sales clerk at the auto parts store that you want **OEM (original equipment manufacturer)** parts. Quality **aftermarket** parts are available as well, but unless you trust your parts seller's recommendations, or you've already used a particular aftermarket brand and had good luck with it, stick with OEM parts.



If you can't find specs for buying and gapping spark plugs in your owner's or service manual or on your vehicle, you'll find them in a "Tune-Up Specification Guide" (called a "spec sheet" for short) at an auto supply store. "Buying the right plugs" in Chapter 6 provides a sample spec sheet and shows you how to use it.



I provide a *Specifications Record* in Appendix B. Make a copy for each vehicle you own and record the specifications for that vehicle on it. I keep a duplicate in my glove compartment so that I always have it when I shop for parts.



How to dispose of empty gasoline cans safely

Although gasoline simply burns, gasoline plus air forms an explosive vapor that can literally take out your entire neighborhood. For this reason, it's wise not to store or carry gasoline unless you're heading far away from any source of fuel (and in that unlikely event, use only a specialized, vented gas can). If you have an old gasoline can around, get rid of it, and do it in a way that won't pollute the environment: Fill the can with water, and, as soon as you can, take the can to a recycling center that handles

toxic waste. If there's no center nearby, ask your local service station if they'll dispose of it for you.

Some people keep gasoline around to clean parts with, but this is extremely dangerous. Mechanic's solvent, available at gas stations and auto supply stores, works better and has been treated with a flame retardant to keep it from burning too freely.



When you go to buy parts, keep in mind that most professional mechanics get discounts at auto parts stores. Ask if you can get a discount given that you're installing the parts yourself. It can't hurt to try. Even if you don't get a price break on parts, you'll still be ahead of the game because you won't have to pay labor charges.

Following safety rules



The first time I tuned my car, I was sure that if I made the smallest mistake, the car would explode when I started it. This seems to be a common delusion, but it just isn't so. If you make a mistake, in most cases all you'll get is silence (which can be just as disconcerting, but not lethal after all). This isn't to say that working on a vehicle is free from danger. Before you do *any* work, be sure to observe the following safety rules:

- ✓ **Don't smoke while you're working on your car — for obvious reasons!**
- ✓ **Never work on your vehicle unless the *parking brake* is on, the *gearshift* is in Park or Neutral, and the engine is shut off.** If you have to run the engine to adjust something, turn it on and off yourself to avoid the risk that a friendly helper may misunderstand and turn the engine on while your hands are in the way.
- ✓ **Be sure that the parts of the engine you're working on are nice and cool so that you don't get burned.** If you're doing a job that calls for a warm engine, be very careful.
- ✓ **Never jack a vehicle up unless the wheels are properly blocked.** I go into more detail about this later in this chapter in "How to Use a Jack Safely" and "How to Change a Tire."



- ✔ **Use insulated tools for electrical work.**
- ✔ **Before using a wrench or ratchet on a part that's "stuck," make sure that if the part suddenly comes loose, your hand won't hit anything.** To avoid the possibility of being injured because your hand slams into something, *pull on wrenches rather than push them whenever possible.*
- ✔ **Take off your tie, scarf, rings, long necklaces, and other jewelry.** If they get caught on parts, they — and you — can be damaged.
- ✔ **Tie back long hair.** If your hair accidentally gets caught in a moving fan or belt, you can literally be scalped.
- ✔ **If you're working with toxic chemicals, such as coolant, cleaners, and the like, keep them away from your mouth and eyes.** Wash your hands thoroughly after using them, and either store them safely away from pets and children or dispose of them in a way that's safe for the environment.
- ✔ **Know that gasoline is extremely dangerous to have around.** Not only is it toxic and flammable, but the vapor in an *empty* can is explosive enough to take out a city block. If you must keep a small amount of gasoline on hand for a lawn mower or chain saw, always store it in a ventilated gasoline can designed specifically for that purpose. Unless you're going far into the wilds, *never* carry a can of gasoline in or on your vehicle. (See the sidebar "How to dispose of empty gasoline cans safely.")
- ✔ **Work in a well-ventilated area to avoid breathing in carbon monoxide if you have to run the engine, or breathing in toxic fumes from chemicals and gasoline.** If possible, work outdoors in your driveway, your backyard, or a parking lot. If you must work in your garage, be sure to keep the garage door open and move the vehicle as close to the door as possible.
- ✔ **Use a work light in dark areas.** If you don't already have one, Chapter 3 tells you what you need to know about buying one.
- ✔ **Keep a fire extinguisher handy.** Chapter 3 contains reasons for this precaution that may surprise you.

So much for the scary stuff. Auto repair safety is all a matter of common sense, really.

How to Fill 'Er Up Yourself

More and more gas stations are shifting toward self-service. If you've been reluctant to abandon the luxury of the full-service lane, chances are that it's going to get more and more difficult to find one. Knowing how to fill 'er up yourself not only prevents you from being stranded with an empty tank when

there's no one available to fill it for you, but it also saves you money on every gallon, every time.



Fill up in the morning, before the temperature rises or fuel is delivered to the gas station. Gasoline expands with heat, which also reduces its energy content per gallon. Since the sales meters at service stations are set for fuel at 60°F, you get less energy and pay more for fuel that's hotter than that. Fuel is often delivered to stations while still hot from the refineries and studies show that fuel in underground tanks can top 100°F even when the weather is cooler.



Always extinguish your cigarette before you start to pump gasoline. If the flame comes in contact with gasoline fumes, it can cause an explosion.

Here are the steps for pumping your own gas:

1. Look at the price window on the pump.

If a previous sale is registered there, reset it by following the next steps to activate the pump and select the grade of gasoline. If the price doesn't disappear, try inserting your credit card or have the attendant clear the machine so that the price window reads "\$0.00."

2. If you're using a credit card, insert it into the slot and follow the instructions in the credit card window.

3. Select the grade of fuel you want, and move the lever on the pump to ON.

4. Unscrew the cap from your *fuel tank*.

5. Unhook the pump nozzle and hose from the pump, and place the nozzle into the fuel tank opening.

Some nozzles have rubber vapor-recovery sleeves that must be depressed to allow the fuel to flow, so push the nozzle as deeply into the filler tube of your vehicle as it will go.

6. Squeeze the trigger on the pump nozzle to allow fuel to flow out of the hose and into your fuel tank.

There's usually a little latch near the trigger that keeps the trigger open so that you don't have to stand there holding onto it and inhaling gasoline fumes. Don't worry about overflows; gas pumps shut off automatically when your tank is almost full.



Engaging the trigger latch gives you time to take advantage of the other services available. You can wash the windows or check the air pressure in your tires and add air if they need it (Chapter 17 has instructions). The trigger latch also enables you to get farther away from the pump instead of standing there breathing in the toxic fumes while the tank is filling.

7. When the fuel stops flowing, the trigger clicks closed and the numbers in the pump window stop moving. Remove the nozzle from the fuel tank and hang it back on the pump.



Never “top off” a tank by adding fuel after the pump shuts off automatically. If you overfill your tank, the fuel may overflow the fill hole or leak out onto the road through an overflow outlet. This is not just a waste of your money; spilled fuel ruins asphalt, pollutes the air, and is a fire hazard. This kind of leakage is especially prone to happen if it’s a hot day because heat makes the fuel in your tank expand.

8. If you used a credit card, press **Yes** for a receipt and replace the cap on your fuel tank while the receipt prints.

How to Open the Hood

How can you do even simple under-the-hood jobs — such as checking the oil, **coolant**, and **transmission fluid**; refilling windshield wiper fluid; and checking **accessory belts** — if you don’t know how to get the hood of your vehicle open?

The good news is that opening the hood is easy and uncomplicated — *if* you know how to do it. Although the location of the hood release may differ from one vehicle to the next, all releases work in pretty much the same way.



If after reading the following instructions and consulting your **owner’s manual** you still can’t figure out how to get your hood open, head for the full-service bay the next time you stop for gas and ask the attendant to show you how to do it. You may pay a little more for fuel and a tip, but the lesson will be worth it — and you can get your windows washed and your tire pressure checked for nothing! (If you’re really short of cash, just ask for \$5 worth of gasoline; the difference in cost will be negligible.) (A sidebar in Chapter 2 tells you why you should check the oil yourself instead of having the attendant do it.)

Here’s how to open the hood yourself:

1. Find your hood release and pop open the hood.

Either consult your owner’s manual, or try to remember the last time a service station attendant opened the hood of your car. Did he or she ask you to pull a lever inside the vehicle? Or did he or she go directly to the front grill?

In newer models, the hood release is often inside the vehicle, somewhere near the steering column or on the floor next to the driver’s seat. (It generally displays the word “Hood” or a picture of a car with its hood up.) In older models, the hood release is behind the grill or the bumper.

If the hood release is inside the vehicle, press, push, or pull it until you hear the hood pop open. If the hood release is at the front, look around and through the grill and feel under the grill and behind the bumper to

find a handle, lever, arm, or button. Then press, push, or pull it from front to back and side to side until it releases the hood.

The hood will open a little, but it will probably be stopped by the safety catch — a metal lever that, when pressed one way or the other, releases the hood so that it can open all the way. This gizmo prevents the hood from opening accidentally and obscuring your vision while you're driving.

2. **With one hand, raise the hood as far as it will go. With the other hand, feel along the area between the hood and the grill for the safety catch. Release it and raise the hood the rest of the way.**
3. **Secure the hood if necessary.**

If the hood stays up all by itself, fine. If it doesn't, look for a hood prop — a long, thin metal rod attached either to the underside of the hood or to the bottom edge of the hood opening. Either lower or lift the rod (depending on where it's located) and fit the end of it into the slot that's provided to hold it in place.



On some vehicles, the hood is held up by two gas-pressurized cylinders known as *hood shocks*. If the hood doesn't feel secure, gas may have leaked out of these units and the hood could come down at any moment. If you're not sure, secure the hood with a broom handle or similar object and have these units checked — or replaced, if needed — as soon as you can.

How to Take Anything Apart — and Get It Back Together Again

I'd never been able to follow the “easy” instructions to put my kids' toys together until I learned the technique that follows. Then I was able to get at my brakes to check them and even lubricate the *wheel bearings* and put everything back together again! The bonus is that this procedure works for *anything* that you need to take apart and put back together again — flat tires, toasters, bicycles, you name it.



NEVER, EVER DO A JOB IN A HURRY.

Allow yourself plenty of time. If things get rough, have some water or a cup of coffee. You may get a whole new perspective when you go back to work. Limit distractions: Turn on your answering machine or take the phone off the hook, keep the kids and the dog away, and relax. If you hit a snag, sit quietly and think about it — don't panic. If the parts fit together before, they'll fit together again.

Follow these instructions, breathing slowly and deeply:

1. **Lay a *clean, lint-free rag down on a flat surface, near enough to reach without having to get up or walk to it.***

You'll lay each part on this rag as you remove it. Consequently, the rag shouldn't be in an area where oil or dust or anything else can fall on it and foul up the parts. If you plan to use something that blasts air for cleaning purposes, leave enough of the rag uncluttered to fold it over the parts resting on it.

2. **Before you remove each part, stop and ask yourself the following questions, and if you're worried about forgetting your answers, make notes:**

- What is this thing?
- What does it do?
- How does it do it?
- Why is it made the way it is?
- How tightly is it screwed on (or fastened down)?



Most amateurs put things back very tightly, in hopes that the part won't fly off. But some things, like bolts that hold *gaskets* in place, shouldn't be tightened too securely because, for example, the bolt threads could be stripped or the gasket could be squeezed out of shape, allowing whatever it's holding in to get out. It's helpful to make notes about how hard each thing was to remove. "Don't over-tighten" or "Be sure it's secure." Some parts require exact *torque* specifications, but we don't deal with them in this book.

3. **As you remove each part, lay it down on the rag *in clockwise order, with each part pointing in the direction it was in before you removed it.***

This is the key to the whole system. When you're ready to reassemble things, the placement and direction of each part tells you when to put it back and how it was oriented.

4. **If you're making notes, assign each part a number indicating the order in which you removed it — Part #1, Part #2, and so on.**

You can even put numbers on the parts with masking tape if you're afraid that the rag may be moved accidentally. Also, note what each part was attached to; for example, "Part #6: Hook at end of arm on left hooks onto knob to right of Part #7." Add a sketch if it helps.

If you work systematically and understand the function of each part, you won't be left with what seem to be extra nuts and bolts at the end of the job.

5. **When you're ready to reassemble everything, begin with the last part you removed, and proceed counterclockwise through the parts on the rag. If you've numbered the parts, they should go on in reverse order.**

Now you're ready to tackle the first job that will give you a chance to apply this technique: Using a jack and changing a tire. You may never need to do it, but if you're stuck with the need to change a flat, you'd better know how.

How to Use a Jack Safely

The most obvious reason to jack up a car is to change a tire, but other jobs such as inspecting brakes may also require you to get under the vehicle. (Even if you're skinny enough to squeeze yourself between the pavement and the underside of your car, you still need room to move around and manipulate tools.) Chapter 3 has detailed information about the different types of jacks as well as items such as **jack stands** (essential) and **creepers** (nonessential, but nice). This section explains how to use a jack safely and efficiently. The next section tells you how to change a tire after the vehicle is in the air.



Before you attempt to jack up your vehicle, observe the following safety precautions:

- ✔ **Jacks are used only to get a vehicle off the ground. They should *never* be used to hold a vehicle in place.**
- ✔ **You must use jack stands when you work underneath your vehicle.** If you don't, you run the risk of serious injury or even death. People have been crushed to death when vehicles that were improperly secured fell on them.
- ✔ **Never jack up a vehicle without blocking the wheels to keep it from rolling.** Use bricks, wooden wedges, or metal wheel chocks to block the wheels at the opposite end of the car from the end that is to be raised. (Chocks are available at a low cost at auto supply stores.) Keep whatever you use for blocks in the trunk so that you don't have to go hunting around if you have to change a flat tire.



If you find yourself faced with the job of changing a tire and you have nothing with which to block the wheels, park near the curb with the wheels turned in. This may not keep you from getting hurt if the car rolls off the jack, but at least innocent motorists and pedestrians won't have to deal with a runaway driverless vehicle!

- ✔ **Never change a tire on a freeway or highway.** Not only can you be seriously injured, but you can also fall prey to carjackers. *Don't exit the vehicle*; instead use a cellphone to call road service or an automobile association such as the AAA. If you don't have a cellphone, hang a white rag or a white piece of paper out of the driver's side window and wait for the highway patrol to rescue you.



Even if you hate cellphones, I recommend that you buy one and keep it in the vehicle for emergencies. You can find a very affordable model that just lets you call 911, road service, and those you'd want to notify in an emergency. It could save your life.



- ✓ **Always park a vehicle on level ground before you jack it up.** If you get a flat tire on a hill and can't coast to the bottom without killing the tire completely, park close to the curb, turn the wheels toward the curb, and block the downside wheels securely to prevent the car from rolling.

These precautions won't eliminate the risk of changing a tire on an incline. If you can't get to level ground or wait for assistance, you change the tire at your own risk.

- ✓ **Be sure that your gearshift is in Park (or in First if you have a manual transmission) and that the parking brake is on before you jack up the vehicle.** The only time you don't want the parking brake on is when you have to be able to rotate a *rear* wheel or remove rear *brake drums* to inspect the brakes. In such a case, make sure that the front wheels are blocked *securely*.



If you remove a wheel and begin to work without making sure that you jacked up the car and blocked it securely, the vehicle can do a lot of damage to itself — and to you — if it falls. (This is not meant to frighten you away from jacking up your car and working on or under it. It's just to emphasize the fact that taking a few simple precautions can keep you safe.)

After you've observed *all* the safety precautions, follow these steps to jack up a vehicle:

1. **If you're going to remove a wheel to change a tire or check your brakes, remove the *wheel cover* or hubcap (if there is one) and loosen the *lug nuts*.**

After the vehicle is jacked up, the wheel will turn freely, which makes it harder to get a wheel cover off and almost impossible to start turning the nuts. Instructions for removing a wheel cover and loosening lug nuts are in the next section, "How to Change a Tire."

2. **Place the jack under the part of the vehicle that it should contact when raised. If you're using jack stands, place them near the jack.**

Where you place your jack depends on whether you're planning to do a one-wheel job, such as tire changing or brake checking, or a two-wheel, whole-end repair job. Many vehicles now have special flat spots on the underside specifically for jack placement.



If you place your jack incorrectly, you can injure your car. To find the proper place to position the jack for your particular vehicle, check your **owner's manual**. If you don't have a manual, ask the service department at your dealership to show you the proper placement. In any event, follow these guidelines:

- Never place the jack so that the weight of the vehicle rests on something that can bend, break, or give.

- If your manual is incomprehensible or lacks jack placement information, try to place the jack so that it touches either the vehicle's frame or the big bar that supports the front wheel **suspension**.
- You can also place jacks near the rear-wheel **axle**, but until you become more proficient at this, I'd stick to jacking up one wheel at a time.

3. Lift the vehicle by using the jack. How you accomplish this depends on the type of jack you're using (see Figure 1-1):

- If you have a *scissor* jack, insert the rod or wrench over the knob, and then crank.
- If you have a *hydraulic* jack, place the handle into the appropriate location and pump up and down. Use nice, even strokes, taking the jack handle from its lowest point to its highest point on each stroke to cut down on the labor involved.

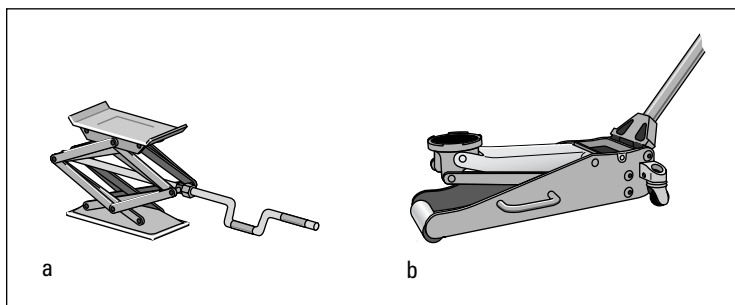


Figure 1-1: A scissor jack (a) and a hydraulic jack (b).

4. Place the jack stands under the vehicle, near where the jack is touching it (see Figure 1-2). Raise the stands until they're high enough to just fit under, and lock them in place. Lower the jack until the vehicle is resting on the jack stands.



Substituting boxes, stones, or bricks for jack stands is very dangerous. They can slip out or break while you're under the car. A jack can do the same thing, so be sure to buy a pair of jack stands and stow them in the trunk if you're traveling out of reach of help if you get a flat tire. You can find information about buying jack stands in Chapter 3.

5. Before you begin to work, wiggle the vehicle a little to make sure that it's resting securely on the jack stands. Then remove the jack.

Wiggling the vehicle also tells you whether you have the wheels blocked properly. It's better if the vehicle falls while all four wheels are in place. (It will bounce just a little.)

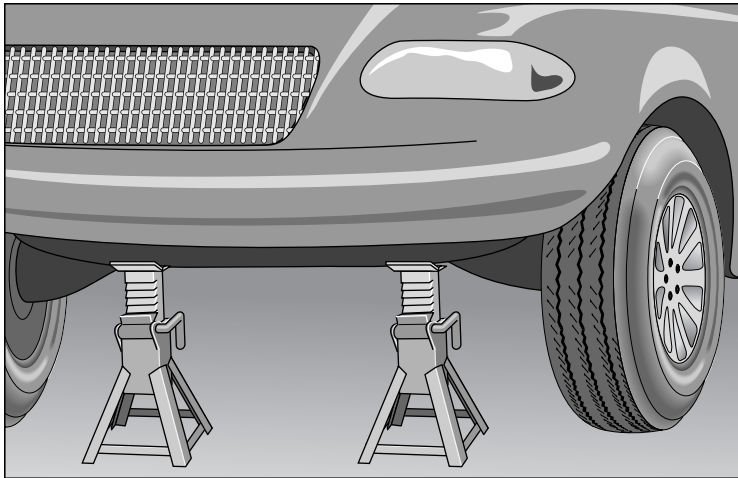


Figure 1-2: Jack stands hold your vehicle up safely.

- 6. When you're finished working, replace the jack, remove the stands, and lower the vehicle to the ground.**

If you're using a scissor jack, simply turn the crank in the opposite direction. If you're using a hydraulic jack, use the rod to turn the pressure release valve. The jack will do the rest of the work for you.

How to Change a Tire

These days, working on your vehicle at roadside can be risky, so the best thing is to use your cellphone to call an automobile association or another source of help. But if you have a flat tire in an area where you can't get a cellphone signal, you can be helpless unless you know how to change a tire yourself. For this reason, *everyone* should have a general idea of what's involved. The task seems easy enough to do:

- 1. Secure the vehicle so that it won't roll.**
- 2. Jack up the vehicle, following the instructions in the preceding section, "How to Use a Jack Safely."**
- 3. Remove the old tire.**
- 4. Put on the new tire.**
- 5. Put away the jack stuff and the old tire.**
- 6. Drive happily into the sunset.**

These may be the basic steps of changing a tire, but the job can get sticky in a couple of places if you're not properly equipped. The following sections explain the steps involved in changing a tire in detail and in order. Check out Chapter 3 for a list of the tools you need.



Because the location and type of spare tire differs from one vehicle to the next, if you aren't familiar with your vehicle it's a good idea to check out the spare (and the jack and **lug wrench**) *before* trouble occurs. While you're at it, make sure the spare has enough air in it and continue to check that periodically.

Removing a wheel cover or hubcap

The first task in changing a flat is to remove the **wheel cover** or hubcap on the injured tire. The following steps tell you how:

1. **If your car has a standard wheel cover or hubcap, use a screwdriver or the flat end of a lug wrench (see Figure 3-16 in Chapter 3) to pry it off.**

Just insert the point of the tool where the edge of the cover meets the wheel, and apply a little leverage (see Figure 1-3). The cap should pop off. You may have to do this in a couple of places, as if you were prying the lid off a can of paint.

If the cover has a delicate finish, consult your owner's manual for instructions on how to remove it without damage. It may pry off or unscrew.

2. **Lay the cover down on its back so that you can put the *lug nuts* into it to keep them from rolling away and heading for the nearest sewer.**

If you're afraid of marring the finish, lay the cover on a rag.

After you remove the wheel cover or hubcap, the next task is to loosen the lug nuts.

Loosening the lug nuts

Lug nuts are those big nuts that hold the wheel in place. How you remove the lug nuts on your vehicle depends on whether you have **alloy wheels** that are

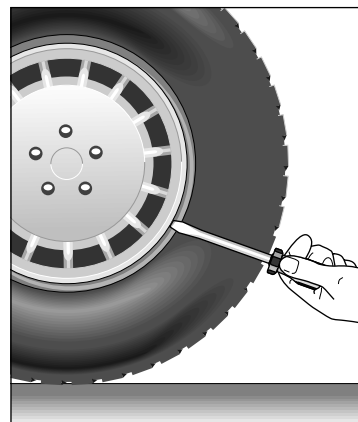


Figure 1-3: You can use a screwdriver to pry a wheel cover loose.



held on by lug nuts with delicate finishes, or hubcaps or wheel covers with standard lug nuts behind them.

Lug nuts with special finishes



The delicate aluminum or chrome-plated lug nuts on alloy wheels need careful handling. *They should never be loosened or replaced with power tools that can scratch the delicate finish.* (Some power tools have rubberized or plastic-coated fittings to avoid damaging the nuts, but those will be of no use to you on the road with no power supply to run them.) Many mechanics prefer to do it all by hand using a special lug fitting to avoid scarring the finish or rounding off the corners of the nuts. You can find this fitting at many parts and tire shops.



Some alloy wheels come with one or more locking nuts on each wheel to help discourage wheel thieves, and you must use the special “key” that came with the car to unlock them before loosening. Be sure you know where your wheel locks are, if your vehicle has them.

Lug nuts with standard finishes

Most garages retighten ordinary lug nuts with a power tool, and unless you’ve done the job yourself by hand, they’re pretty hard to loosen yourself. (Take my advice in Chapter 3 and buy a *cross-shaft* lug wrench. Figure 3-16 shows what one looks like.)



To make the job easier if an emergency arises, you may want to go out and try to remove the lug nuts on your vehicle now, following these instructions. If you have problems, resolve them now so that you won’t have to struggle at the side of the road.

- 1. Find the end of the wrench that fits the lug nuts on your vehicle, and fit it onto the first nut.**

Always work on lug nuts in consecutive order so that you don’t forget to tighten any later.

- 2. Apply all your weight to the bar on the left.**

This starts turning the nut *counterclockwise*, which loosens it.



I don’t suggest using this kind of strong-arm tactic on lug nuts with special finishes, but if an ordinary nut has been put on with a power tool and you can’t get it started, a piece of hollow pipe, fitted over that left-hand arm of the cross-shaft wrench, magically adds enough leverage to start the nut easily (see Figure 1-4). After you replace the nut yourself,

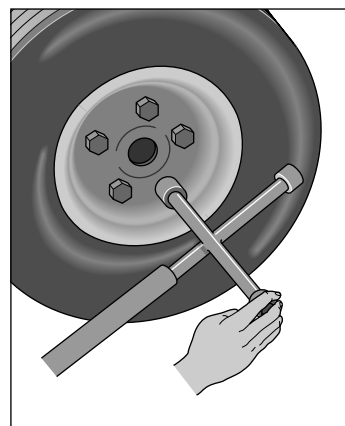


Figure 1-4: A hollow pipe and a cross-shaft wrench can loosen the tightest lug nuts.

this aid is no longer necessary. But remember, the longer the arms on your lug wrench, the more leverage you have.



Don't remove the lug nuts completely; just get them loose enough to remove by hand *after* jacking up the vehicle.

Changing the tire

Before you jack up your vehicle, remove the spare from the trunk. After the vehicle is safely jacked up and the lug nuts are off, follow these instructions to change the tire:

1. **Roll the spare tire to the scene of the action if you haven't already done so.**

2. **Grasp the flat tire with both hands and pull it toward you.**

The flat tire sits on the exposed bolts that the lug nuts screw onto. As you pull the flat off, it should slide along the bolts until, suddenly, it clears the end of the bolts and you find yourself supporting its full weight. Tires are heavy, and you'll be quite happy to lower it to the ground (if you haven't already dropped it).

3. **Roll the flat along the ground to the rear of the vehicle to get it out of the way.**

4. **Lift the spare onto the lug bolts.**

Because tires are heavy, you may have a little trouble lifting the spare into place — especially if you're not accustomed to lifting heavy things.

5. **After you have the spare tire in place, replace the lug nuts and tighten them by hand.**

Give each lug nut a jolt with the wrench to get it firmly into place, but wait until the car is on the ground before you really try to tighten the lug nuts.

6. **Replace the jack, use it to lift the vehicle off the jack stands and lower the car to the ground.**

7. **After the vehicle is resting on the ground, use the lug wrench to tighten the lug nuts as much as you can.**

If your vehicle has alloy wheels, tighten the lug nuts until the lug wrench won't move any more, then press down on the wrench's cross arm with all your weight, but don't jerk it or kick it or jump on it as you could cause the wrench to damage the finish on the nut.

Standard lug nuts are sturdier than those on alloy wheels, but you don't want to twist them off the bolts or ruin the threads. However, you don't want the wheel to fall off, either. If you're worried about tightening them



sufficiently, use your hollow pipe, or step on the right-hand arm of the lug wrench after the nut is tight.

8. Replace the wheel cover or hubcap.

If your car has wheel covers with a delicate finish, the owner's manual should provide instructions for replacing it. If not, reverse the order of things you did when removing it (if you had to pry it off, then it probably pops back in with a sharp tap of your hand; if it unscrewed like a big jar top, then it screws back in).

If your car has hubcaps, place the hubcap against the wheel and whack it into place with the heel of your hand. Cushion your hand with a soft rag first so that you won't hurt it. And don't hit the hubcap with a wrench or hammer — you'll dent it. Whack it a couple of times, in a couple of places, to be sure that it's on evenly and securely. (Even secondhand hubcaps can be expensive to replace, and that's *if* you can find the one you need.) If it's too much of a hassle, or if you don't have the time to replace the hubcap, you can take it home and install it later; it's mostly ornamental, and you can drive for a while without it. But do replace it soon because it helps keep dust and dirt out of your brakes and bearings.

9. Put the flat in the trunk where the spare was located, and put your tools (including wheel blocks) away.



Get that flat fixed immediately; you don't know when you may need it again!

And make sure that it's repaired properly. Instead of dismounting the tire from the wheel rim, inspecting it, fixing it, and remounting it, some service stations simply plug the flat from the outside. Several states now outlaw this procedure, known as "outside-in" repair, and patches should never be used if the hole is in the sidewall rather than the tread. In either case, be sure to tell the service facility that you *don't* want the tire plugged from the outside; you want the flat corrected the proper way.



If you get caught in the middle of nowhere with a flat tire and are unable to call or wait for service, and if you don't feel safe — or capable of — changing it yourself, a can of nonflammable inflator/sealant can get you rolling again in minutes. Simply screw the nozzle of the can onto the valve stem of the flat tire. It will fill the tire with air and some sort of goop that temporarily seals the puncture. Because there's still some question about how permanent this fix is and its ultimate effects on your tire, look for a major brand that's environmentally friendly and can be rinsed out of the tire with soap and water by a tire repair professional. Use this product *only* in emergencies, get to a service station as soon as possible, and be sure to tell them that you used canned inflator/sealant and that they should remove the stuff before fixing the tire.



If reading these instructions makes you think that you'd rather languish by the side of the road for hours than undertake changing a tire yourself, consider outfitting your vehicle with *run-flat* tires. Although these tires are more expensive and some require special wheels, they make it possible to drive with a flat to the nearest service station without ruining the tire. Chapter 17 has more information about run-flat tires.

How to Get In When You're Locked Out



If you tend to leave the keys in your car fairly often, consider hiding an extra key somewhere on the vehicle. A little magnetic key box that sticks to the metal surface of a steel body or frame is best, but *be sure to place it in an obscure and hard-to-reach area where it can't jiggle loose and fall off*. I leave the location up to you — be imaginative. Struggling a little to reach that extra key is better than having car thieves find it. And *don't* hide your house key with it.

Fortunately, many new vehicles come with electronic door openers or “digital keys” that don't allow you to lock the doors with the keys in the vehicle. The downside is that if you lose the gadget, it can take days and hundreds of dollars to replace it, and you'll probably need to have the vehicle towed to a dealer who will order a new key.



If your vehicle has an electronic door opener, you may be able to get the door open, but if you've lost the opener outside your vehicle, the ignition may fail to start without it. Some vehicles have override switches for this eventuality, so find out whether you'd be able to start your vehicle without your opener, and locate the override switch now, if there is one.

Assuming that you've decided not to risk hiding an extra set of keys on your car, here are a few things you can try to get in without a key:

- ✓ **If your vehicle has door locks that are recessed inside the interior door handle**, get professional help.
- ✓ **If you have the old-style door locks with little buttons on the window ledge**, straighten a wire coat hanger and bend the end into a little hook. Insert it between the rubber molding and the side window and then carefully hook it around the door button and pull it up.
- ✓ **If you have smooth buttons**, you can try to hook one using the hanger technique, but most will refuse to budge.
- ✓ **If you happen to lock yourself out of the vehicle while you have the trunk open**, you may be able to move the rear seat out of the way and gain access to the rear of the car (or you can hide an extra ignition key in the trunk).



If you need professional help, call emergency road assistance and ask if they will be able to open the door. If not, ask them to send a local locksmith. The good news is that each car key is coded by the auto manufacturer, and if you have the key code number and personal identification, a locksmith can make you a new key. Write down the key code number and leave it where someone at home can read it to you in an emergency. Also record it — without identifying what it is — in your pocket address book or in your wallet *before you lose your keys*. If you bought the vehicle, new or used, from a dealer, the dealer may still have the number on file or the automaker may have a record of it. Failing that, a good locksmith may be able to analyze a key in fairly new condition and come up with the proper code for it.

Chapter 2

Preventive Maintenance: A Monthly Under-the-Hood Check

In This Chapter

- ▶ Preventing 70 percent of the causes of highway breakdowns
- ▶ Checking the air filter, accessory belts, battery, and hoses
- ▶ Dipping into fluid levels
- ▶ Looking at wiring, wipers, and tires

Everyone knows a few chronic tire kickers. Before they get in and drive off, these people habitually walk around their cars and kick the tires to make sure that they aren't flat. The same people habitually open and close all the cabinet doors in the kitchen and check the gas jets every time they go past the stove. You may laugh at them, but they're probably rarely caught with flat tires, open cabinets, or leaking gas. Why not learn from these folks and make a habit of checking the little things under the hood of your vehicle — maybe not every time you drive somewhere, but definitely once a month and before starting out on long road trips.



If the idea of committing yourself to a regular under-the-hood checkup seems less than alluring, look at it this way: *Spending 15 minutes a month checking under the hood can prevent 70 percent of the problems that lead to highway breakdowns!*

What you need to check regularly is anything that can run out of fluid, lose air, jiggle loose, or fray after use — in other words, things like **coolant**, tire pressure, hoses, and **accessory belts**. This chapter explains what to look for, how to look for it, and what to do if you discover that something needs to be replaced or refilled. You'll be happy to know it doesn't require any special tools.



I provide a *Maintenance Record* in Appendix B. Make a copy for each of your vehicles to keep track of what you check and what you replace each time you do an under-the-hood checkup. Appendix B also contains a *Specifications Record*; to avoid having to return parts that don't fit your vehicle, make a copy of this "spec sheet" for each of your vehicles, fill in the appropriate part numbers, and keep it in the glove box so that you have it whenever you buy parts.



Whenever you encounter a term set in **this font**, you'll find it defined in the glossary in Appendix A.

Getting Your Bearings under the Hood

Once a month, in the morning before you've driven your vehicle, arm yourself with a clean, lint-free rag and the household tools mentioned in this chapter, and open the hood of your vehicle. (If you've never done that, flip back to Chapter 1.) Then check the items in the sections that follow. The checkup may take a bit longer the first time you do it, but after that you should be able to whip through this check in about 15 minutes. As a matter of fact, you may want to grab this book and your **owner's manual** (if you have one), go out to your vehicle, and locate each part while you read. Figure 2-1 helps you find each part. Make a game of it. Enjoy!



When you do the check for real, if you find that the **coolant**, oil, **transmission**, brake, or **power-steering** fluid levels are low, fill them to the proper levels and check again in a couple of days. If any of them are low again, visit a mechanic to find out why you're losing fluid and correct the problem.

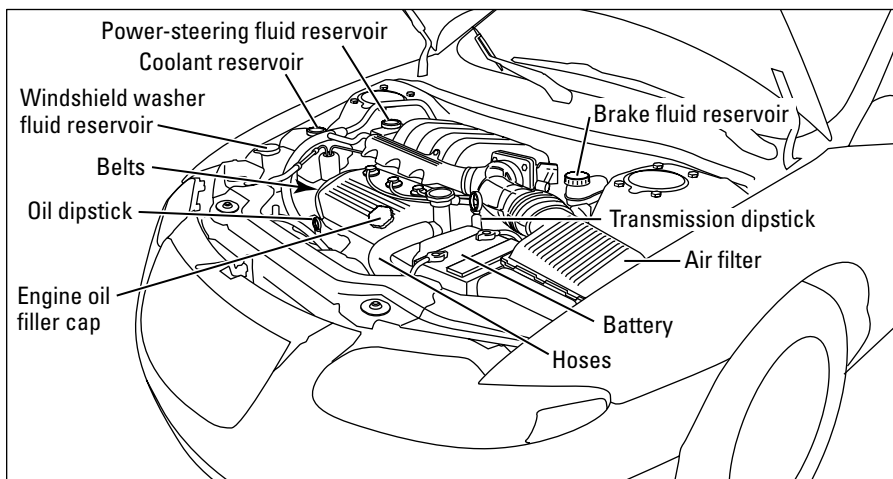


Figure 2-1: Where to find parts under the hood.



To find out how to dispose of hazardous materials like batteries and the fluids in automotive systems, visit www.1800cleanup.org/default.asp. Just insert your zip code in the search box to find recycling centers in your area for many kinds of toxic materials. If you don't have access to the Internet, ask your local auto shop if they will accept your hazardous materials for recycling.

Check the Air Filter

In most newer, fuel-injected vehicles, the air filter is found inside a rectangular box called a **cold air collector box** (see Figure 2-2). It's usually close to the front of the vehicle near the inside of one of the fenders. Air that's scooped up by the front of the vehicle moves through an air intake tube into the air filter inside the box (see Figure 2-2). On older fuel-injected engines and carbureted engines, the filter is found in the **air cleaner**, which sits atop the engine. As you can see in Figure 2-3, it's large and round with a snorkel sticking out of the side to facilitate the intake of fresh air. Your owner's manual should have instructions on how to locate and get at your air filter. If you have no manual, see Chapter 8 for general instructions.

To find out if your air filter needs to be replaced, just lift it out (it isn't fastened down) and hold it up to the sun or to a strong light. Can you see the light streaming through it? If not, try dropping it *lightly*, bottom-side down, on a hard surface to jar some dirt loose. (Don't blow through the filter — you can foul it up that way.) If you drop the filter a few times and it's still too dirty to see through, you need a new one. Chapter 7 tells you more about air filters, and Chapter 8 has instructions for buying and replacing them.



Because the air filter extracts dirt and dust particles from the air, you should change it at least once a year or every 20,000 miles, whichever comes first — unless yours gets very dirty before then. If you do most of your driving in a dusty or sandy area, you may need to replace your air filter more often.

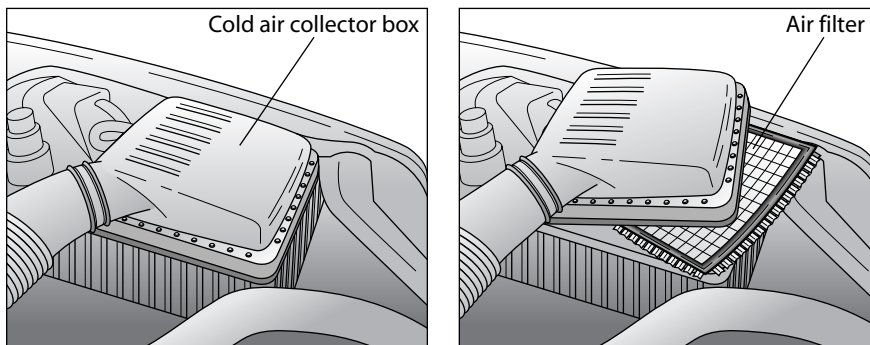


Figure 2-2: The cold air collector box houses the air filter.

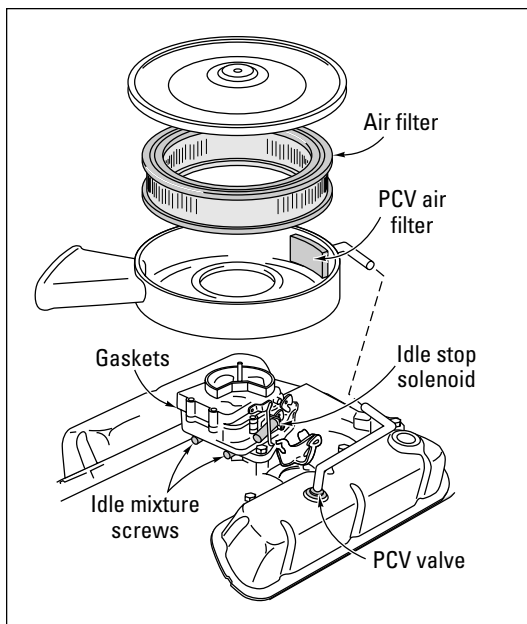


Figure 2-3: On carbureted vehicles, the air filter is inside the air cleaner.

Check the Accessory Belts

If you're under the hood of your vehicle and can see without having to remove shields or cowlings, take a look at the serpentine **accessory belt** that drives the **alternator**, the **power-steering pump**, the air conditioning compressor, the water pump in many cases, and other parts of a modern vehicle. (If you drive an older car, look at the separate belts.) Figures 2-4 and 2-5 show you what both types of belts look like.



If you can't access an accessory belt easily to check it yourself, have it checked when you have the vehicle serviced or if the belt gets noisy or any of the equipment it drives begins to malfunction.

If you can see an accessory belt easily, here's what to look for:

- ✓ If the belt “gives” more than ½ inch when you press on it but otherwise is in good condition, it may just need to be adjusted.

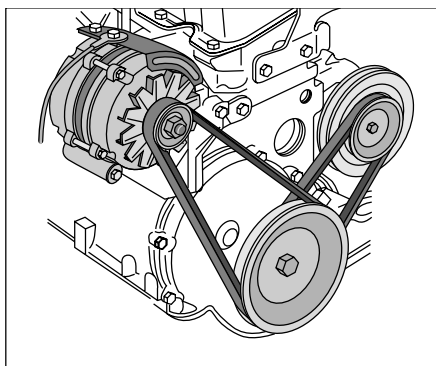


Figure 2-4: Accessory belts.